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A61L15/00 C

(12) UK Patent Application (19) GB (11) 2 004 201 A

(21) Application No: 7832203
(22) Date of filing:
3 AUG 1978
(23) Claims filed:
3 AUG 1978
(30) Priority data:
(31) 7727569
(32) 13 SEP 1977
(33) FRANCE (FR)
(43) Application published:
28 MAR 1979
(51) INT. CL.²: B05D 5/00
A61F 13/18//B32B 5/26
5/30
(52) Domestic classification:
B2E 1123 CD
B5N 0526 0530
(56) Documents cited:
GB 1515768
GB 1228877
GB 1161015
GB 1126524
GB 969327
GB 502733
GB 280961
(58) Field of search:
A5R
B2E
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(54) COATED ABSORBENT STRUCTURES

(57) A method of manufacturing absorbent structures e.g. menstrual towels, nappies, surgical dressings and wiping towels, wherein a liquid-absorbing material e.g. in the form of a powder, is secured to a support e.g. a film or fibrous pad by depositing a binding agent for example poly(vinyl alcohol), particularly in the form of an aqueous solution or dispersion. In one procedure after the liquid-absorbing material and the binding agent have been applied to one pad, a second pad is applied to form an integral structure with the binding agent and in another procedure the liquid-absorbing material is incorporated between two pads, and a liquid binding agent is applied to the external surface of one pad and percolates through to form an integral structure.

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SPECIFICATION

ABSORBENT STRUCTURES

This invention relates to a method of making absorbent structures formed of a support associated with particles of a liquid-absorbing material.

During the last twenty years considerable development has been applied to products for personal and domestic sanitary use. In particular the production of products utilizing cellulose fibres in the form of padding obtained by dry shredding of sheets or rolls or pulp has rapidly increased. Menstrual towels, nappies for babies and dressing are particular examples of such products.

Cellulose fibre pads, although possessing satisfactory capacity for absorbing liquids, have the disadvantage of a poor liquid retention capacity. Furthermore an increase in the quantity of liquid absorbed can only be obtained by an increase in the quantity of cellulose fibres.

Consequently attempts have been made to synthesize compounds which are capable both of absorbing water and retaining it. Such compounds include modified polysaccharides and synthetic polymers. The methods usually employed for producing such material include converting a water-insoluble into a soluble compound, or in converting a water-soluble compound by treatment with a cross-linking agent, to prevent solubilization in water. By such means it is possible to obtain a compound distending in the presence of water but not solubilizing, the water being absorbed in a quasi-irreversible way, under the usual conditions of use.

Such products include modifed cellulose ethers, alginates and polyacrylates. Such so-called "super-absorbent" products occur in the form of powders, fibres or films.

Such powdery products are readily obtainable in the dry state by atomization, but they are of necessity very hydrogscopic, which raises numerous difficulties.

For example French patent specification 2319434 describes a method of providing on a support, particles of a modified cellulose ether (carboxymethyl-cellulose treated by a polyfunctional derivative of acrylamide) consisting in moistening the support with a liquid (e.g. a solvent or water) and subsequently depositing the absorbent derivative thereon. The particles distend and adhere to the support and the assembly is dried to eliminate the liquid vehicle. The disadvantage of such a method lies in the distention of the absorbent particles followed by the drying operation. A large part of the effectiveness of the particles becomes lost because of the change in their surface state. Furthermore particles may adhere to each other which leads to the formation of a film even when depositing the particles of a single layer.

American patent specification 3919042 describes a similar method but for a different purpose which consists in spraying particles of start by electrostatic process onto a sheet of cellulose fibres containing at least 25% water.

Another method consists in passing water vapour through a fibrous pad containing absorbent materials.

French Patent specification 2066324 proposes shredding a sheet of cellulose fibres in the presence of an absorbent powder, and then moistening the assembly so as to cause the particles to adhere to the fibres.

The preferred means consists of a treatment by water vapour. It is still unfortunately necessary to dry the assembly which induces an appreciable loss of absorbent capacity. Furthermore industrial plant to carry out such method is very difficult to operate. When the absorbent powders are mixed with fibres in suspension in air in a chamber, the passage of water vapour inevitably draws a great quantity of powder towards the walls of the chamber on which they cohere.

A similar technique is described in British patent specification 1354406 whereby sheets of cellulose wadding, optionally impregnated with a cationic compound, are covered with a powder of a hydroabsorbent polymer, stacked and subjected to treatment by water vapour. The various layers are thus connected by a distending substance in the presence of an aqueous liquid.

Similarly German patent specification 489308 describes an absorbent structure such as a menstrual towel or dressing, comprising a layer of absorbent powder of starch, dextrin or gelatin between two pads of cellulose fibres. The layer of powder is fixed by moistening.

Another method consists in applying to a cellulose substrate a gel distended with water (cross-linked polyacrylamide) and drying the laminate obtained. This technique however does not provide very satisfactory results as demonstrated in the table of Examples 1 to 3 of French patent specification 2133432.

French patent specification 2283255 is concerned with the improvement of the hydrophilicity of non-woven fabrics of synthetic fibre base having useful sanitary and cleaning applications. The fibrous structure is impregnated with a bath of dressing containing cellulose ether before the usual treatment with resins or binding agents. Thus fabrics are obtained exhibiting good hygroscopic properties even after several washings.

It was unexpectedly discovered according to the present invention that it is possible to manufacture absorbent structures by applying particles of a liquid-absorbing product to a support and by depositing a binding agent on the composition obtained.

The support can be a synthetic film or may be a fibrous material. Deposition of the binding agent may be effected by spraying or by transfer, e.g. a thin layer of a solution or dispersion of the binding agent on a roller surface is transferred to the supported liquid-absorbing product by applying the roller thereto.

According to a preferred form of the invention, particles of the liquid-absorbent material e.g. in the form of a powder, are deposited on the surface of the support e.g. film or fibrous material. Thus particles of the absorbent product are uniformly distributed on one surface of a fibrous material.

The fibrous material may be formed of a padding obtained by dry process or by shredding of a sheet of cellulose fibres or of a sheet of cellulose wadding (tissue-wadding) or of a sheet of paper or of any other support comprising fibres.

While any type of binding agent may be used, particularly good results are obtained with a binding agent which is an aqueous solution of poly(vinyl alcohol). A 15% solution produces absorbent structures of good quality. Another type of binding agent composition which may be used according to the invention is in the form of an aqueous dispersion e.g. latex, for example an acrylic latex to fix the particles of liquid-absorbing material without substantially changing their absorbent power.

The liquid-absorbent material may be present on the support at a loading of between 20 and 350 g/m². The binding agent may be deposited at a loading of from 2 to 20 g/m² based on dry binding agent. However a loading of binding agent as low as 2 g/m² can provide satisfactory fixing of the absorbent particles.

An advantage of the present invention is that the absorbent product may be deposited in an amount which corresponds substantially to more than one single layer of particles. Thus for particles of a volume mass of 1 and a diameter of 0.1 mm. a deposit of a single layer corresponds to a loading of 50 g/m², and by the method according to the invention, a deposit exceeding a loading of 250 g/m² may be obtained.

According to a particular embodiment of the invention, it is advantageous to deposit on the layer of particles a second fibrous pad. The binding agent thus serves both to fix the particles and to render the two pads integral.

A particular method of effecting the application of the binding agent is by depositing the binding agent on a composite formed by a layer of the liquid absorbing material between two fibrous pads. By this procedure the moist binding agent percolates through the composite to render it an integral structure.

If desired the structure obtained can be dried.

The following examples of the invention are provided.

EXAMPLE 1

Alginate powder obtained under the Trade Mark Algum 2600 sifter 100 was deposited at a loading of 70 g/m² on a pad of cellulose fibres of the type used in the making of menstrual towels.

The deposit was then fixed by spraying an aqueous solution of 15% of poly(vinyl alcohol) obtained under the Trade Mark Rhodoviol 4/125. The structure obtained was then dried. By this procedure a loading of 6 g/m² of the poly(vinyl alcohol) was obtained.

The absorptivity of the pads was not affected, and a substantial inprovement in dry cohesion thereof was obtained.

EXAMPLE 2

250 g/m² of an alginate powder used in Example 1 was deposited on a pad of fibrous material and an aqueous solution of 15% of poly(vinyl alcohol) spayed thereon to provide a film of loading 7 g/m² on the surface. Under these conditions only 2/3 of the powder became fixed.

The deposition of a second pad of fibrous material onto the treated pad allowed the unfixed portion of the powder to become fixed thereto, thus securing an integral structure.

EXAMPLE 3

By means of a spraying of 9 g/m² of poly(vinyl alcohol) onto a fibrous pad a deposit of 250 g/m² of polycarboxylated synthetic absorbent obtained under the Trade Mark Permasorb 10 was fixed to the pad.

EXAMPLE 4

On a pad of cellulose fibres obtained by dry shredding of a sheet of pulp, 250 g/m² of alginate and of Permasorb were applied, and fixed by spraying of poly(vinyl alcohol) thereon.

A 5 g sample was placed in a cylindrical basket provided with a conical portion, and plunged for 3 minutes in water and then drained for 1 minute.

The absorption results are set forth in Table 1.

TABLE 1

	Absorption of water
Test fibre pad	105 g.
Pad+poly(vinyl alcohol)	96 g.
Pad (50)+Alginate (50)+ poly(vinyl alcohol)	124 g.
Pad (50)+Permasorb (50)+ Poly(vinyl alcohol)	255 g.

EXAMPLE 5

On a 300 g. pad of cellulose fibres a modifed starch obtained from Grain Processing Corporation under their Reference 35A 100 was deposited at a loading of 160 g/m², and was fixed by spraying an aqueous dispersion of a 22% acrylic latex obtained under the Trade Mark Primal P 339 at a loading of 10 g/m².

The formation of a thin peelable skin was observed. 5 g samples were tested as in Example 4. The results obtained are set forth in Table 2.

TABLE 2

	Absorption of water
Test fibre pad	104 g
Pad (65)+Powder (35)+ (physical mixture)	189 g
Pad (65)+Powder (35)+ Latex	184 g

It is consequently observed that the deposition of a not particularly absorbent film of latex does not substantially change the capacity for absorption of structures obtained according to the invention.

It was also observed that the fixing of powders was satisfactory by the deposition of 2 g/m² of latex.

Further tests showed that the forming on a fibre pad of a film obtained by the spraying of latex does not affect the qualities of absorption of the pad, as set forth in Table 3.

TABLE 3

	Absorption of water	
	Drainage 20 sec.	Drainage 60 sec.
Test pad	113 g	108 g
Pad+8 g/m² of Primal	116 g	108 g
Pad+13.5 g/m² of Primal	112 g	105 g
Pad+20 g/m² of Primal	110 g	103 g

EXAMPLE 6

Alginate powder was deposited uniformly at a loading of 15% by weight on a surface of a pad of cellulose fibres. Various techniques for the application of fixing powders were used as set forth in Table 4.

TABLE 4

Method of application	Effectiveness of fixing
Spraying with steam	unsatisfactory
Spraying with water	unsatisfactory
Spraying with an aqueous solution of poly-(vinyl alcohol)	excellent

EXAMPLE 7

On a support film of crinkled polypropylene, the powder used in Example 5 was deposited at a loading of 160 g/m² and an aqueous dispersion of Primal in the form of a fine mist was then sprayed thereon, until a deposit of loading 9 g/m² was obtained. After drying it was possible to turn back the film of polypropylene without the powder becoming detached. When incorporated in a menstrual towel this modified film allowed both an increase in capacity for absorption and in a "barrier" effect comparable to an impermeable film.

EXAMPLE 8

On a support formed of a thin non-woven layer of thermoplastic fibres fixed by thermosealing on a mesh of polypropylene reinforced by polyamide filaments, obtained under the Trade Mark Scrinyl, a powder obtained under the Trade Mark Algum 2600 filter 200 was deposited at a loading of 50 g/m². 20% of the powder remained unfixed.

A deposit of 9 g/m² of latex obtained under the Trade Mark Coesol 4, was sprayed using a dispersion diluted 1/1, allowed th fixing of 40 g/m² of the powder. After drying in air, the composite obtained was rolled up. The product can be used for example in agriculture to fix soils whilst retaining moisture.

EXAMPLE 9

10 g/m² of a dispersion of Coesol 4 diluted 1/1 was deposited on a sheet of Teflon (Trade Mark). The film of damp latex was deposited by transfer onto a pad of fibres including 160 g/m² of Algum powder.

By means of a scraper, the composite of the sheet was detached. After drying it was established that the powder was satisfactorily held on the fibrous pad.

Many variants of the method according to the invention may be used, for example to produce a uniform or patterned distribution of absorbent products.

The choice of binding agents used in the process of the invention may be determined by a satisfactory diffusing capacity of the liquid phase present and the rheological characteristics of a dispersion when used.

Absorbent structures obtained in accordance with the invention may be used as menstrual towels, nappies for babies, medical and surgical dressings, industrial wiping products and fixing agents for soils and for water retention.

The depositing of binding agent by transfer can be effected with embossed rollers allowing a patterned deposit to be obtained.

CLAIMS

1. A method of manufacturing an absorbent structure, characterized in that particles of a liquid-absorbing material are applied to a support, and a binding agent is deposited on the composition obtained.

2. A method according to Claim 1, wherein the binding agent is applied by spraying.

3. A method according to Claim 1, wherein the binding agent is applied by transfer.

4. A method according to any of Claims 1 to 3, wherein the said support is a fibrous material.

5. A method according to any of Claims 1 to 4, wherein the said particles of liquid-absorbing material are applied to one surface of the support.

6. A method according to any of Claims 1 to 5, wherein the said particles of liquid-absorbing material are applied to the said support at a loading of between 20 and 350 g/m².

7. A method according to any of Claims 1 to 6, wherein the said binding agent is applied at a loading of from 2 to 20 g/m², based on the dry binding agent.

8. A method according to any of Claims 1 to 6, wherein the said binding agent is applied in the form of an aqueous solution of poly(vinyl alcohol).

9. A method according to any of Claims 1 to 6, wherein the said binding agent is applied in the form of an aqueous dispersion.

10. A method according to any of Claims 1 to 9, wherein the said support is a synthetic film.

11. A method according to any of Claims 1 to 9, wherein the said support is a fibrous material.

12. A method according to Claim 11, wherein the said fibrous material is a pad of cellulose wadding.

13. A method according to Claim 9, wherein the said fibrous material is dry-shredded cellulose fibres.

14. A method according to any of Claims 11 to 13, wherein a second fibrous pad is applied to the absorbent structure after treatment with the binding agent.

15. A method according to Claim 14, wherein the said second fibrous pad is a pad of tissue wadding.

16. A method according to any of Claims 11 to 13, wherein the said binding agent is deposited by transfer on the composite formed by a layer of the said liquid-absorbing material between two fibrous pads.

17. A method according to any of Claims 1 to 16, wherein the said particles of liquid-absorbing material are in the form of a powder.

18. A method as claimed in any of Claims 1 to 17, wherein a drying step is applied to the absorbent structure obtained.

19. A method of manufacturing an absorbent structure as claimed in Claim 1, substantially as hereinbefore described, with particular reference to the Examples.

20. An absorbent structure obtained by a method according any of Claims 1 to 19.

21. An absorbent structure according to Claim 20, which is a menstrual towel, nappy, surgical dressing or wiping towel.

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1979
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.